



Cover illustration by David M. Russell, Graphic Designer with Tessada & Associates, Inc., on the JIMMS contract. Dave is a talented artist who has worked at JSC in the Graphics Department for 19 years. Dave's unique style of pencil sketches has been requested for many projects over the years. His work can be seen on programs, presentations and newsletters. One of his most memorable designs is an exceptional tribute to the *Columbia* crew and their mission and is permanently displayed in the Air and Space Museum in Washington, D.C.

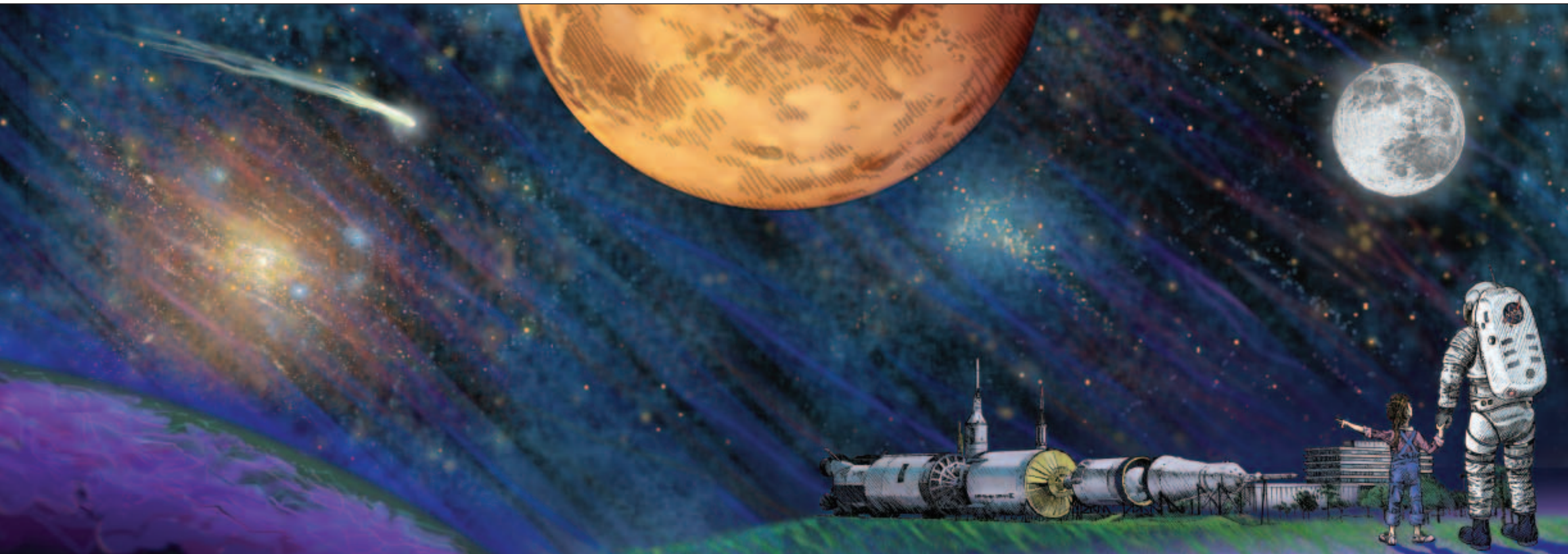
volume number

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# Roundup

SPACE CENTER ROUNDUP

Lyndon B. Johnson Space Center



## Space Center Roundup

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Johnson Space Center

# 2004 in review

SPECIAL EDITION ROUNDUP ■ FEBRUARY 2005 ■ HOUSTON, TEXAS

# Making a difference



NASA/Blair JSC2004E01459

*Making a difference is an extremely important aspect of the human endeavor. All of us want to contribute to the betterment of our families, our communities and our society. President Ronald Reagan once said, “Many people go through life wondering if they’ve made a difference. The U.S. Marines don’t have to worry about that.” Being a Marine, I am very proud of that statement. Frankly, I think the same thing can be said about the women and men on the JSC team.*

*One only has to scan through this edition of the Roundup, with its reports on our achievements over the past year, to be impressed with the remarkable contribution that our team is making to every aspect of human spaceflight. I continually receive reports from NASA Headquarters and other center directors regarding the excellent work of JSC team members who make a positive difference while supporting their activities. The weekly activity reports also verify that, at JSC, making a difference is a way of life.*

*Making a difference can be painful, particularly in our line of work. Human spaceflight stirs strong passions in those of us who are involved, as well as those who are interested in this noble endeavor. Our miscues, large or small, real or perceived, often become national news and generate extreme criticism on the front pages of newspapers and lively discussions in the halls of Congress. The plethora of criticism could lead us to lose faith in ourselves and what we are about.*

*We cannot allow this to happen! Always remember how special you are and how important your work is to the future of our nation and the world. If we “stick to our guns” and approach all that we do each day, one step at a time, in accordance with our values of Safety, the NASA Family, Excellence and Integrity, our activities will lead to mission success in our journey of exploration and discovery. We will not be denied!*

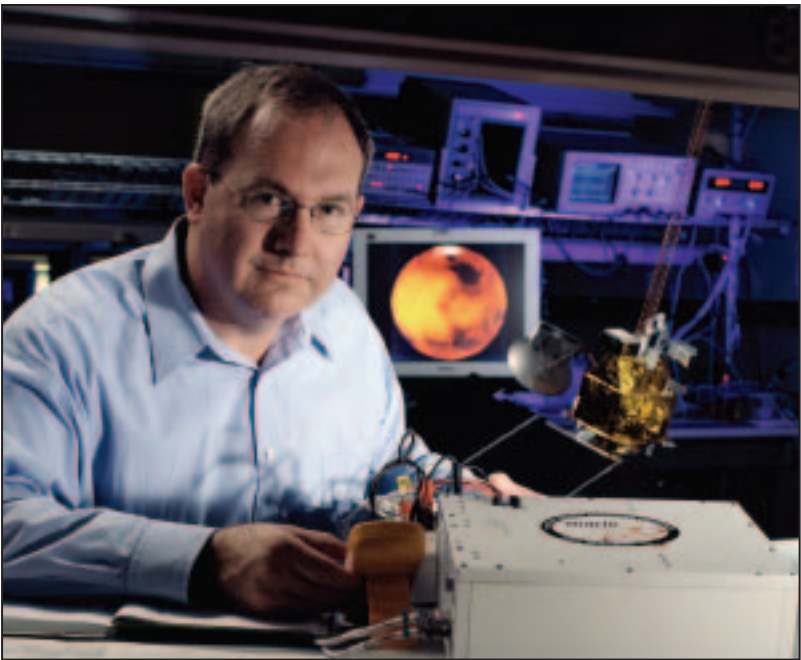
*Be assured that you do make a difference and can be counted among those precious few who are helping humankind into the outer reaches of space. I’m proud to be on your team!*

**IT’S GREAT TO BE ALIVE AND IN HOUSTON!**

*Jefferson D. Howell Jr.*



NASA/Blair JSC2004E40102



NASA/Markowitz JSC2004-00235



NASA/Blair JSC2004E21046



NASA/Markowitz JSC2004E55431

EXPLORING EVERY DAY



NASA/Blair JSC2004E39213

## Up, up and away

The Re/Max Ballunar Liftoff Festival took place at JSC in August. The event was a tribute to human flight – from the beauty of hot air balloons to the high-tech world of modern spaceflight. The Ballunar Festival included air balloon competitions, glows, JSC exhibits, entertainment and more. As a part of the festival, the public had the opportunity to visit several NASA buildings on a NASA mini-tour.

NASA FAMILY

# Community

**TO SHOW ITS APPRECIATION** of the support of the surrounding Houston-area community, the JSC Family kept busy this past year. Events such as the Space Shuttle Service Life Extension Program Summit, Super Bowl, Rodeo Houston, Houston International Festival, All-Star FanFest, Home Run Derby, Ballunar Liftoff Festival, Wings Over Houston, and the National Society for Black Engineers Region Five Fall Regional Conference were all supported by the JSC Family.

**Rodeo Houston** spectators were treated to a moving video tribute to NASA, complete with historical film and inspirational music. Special recognition was also given to those astronauts who died in pursuit of space exploration.

**All-Star FanFest** JSC furnished a large exhibit at the George R. Brown Convention Center for the All-Star FanFest. At the All-Star Diamond Clinic, JSC and Major League Baseball provided an interactive exhibit called the NASA Skills Obstacle Course. This particular clinic compared the rigors of astronaut training to the complexity of baseball training. Fans had the opportunity to navigate the specially designed obstacle course to get a sense of what it takes to, in essence, “play baseball on the Moon.”

**Home Run Derby** Approximately 60 JSC scientists, engineers and support personnel were also able make a special contribution to the Home Run Derby festivities. While the national anthem played in the background, JSC employees helped to carry a giant United States flag onto the baseball field.



NASA/Blair JSC2004E46027



NASA/Blair JSC2004E03304

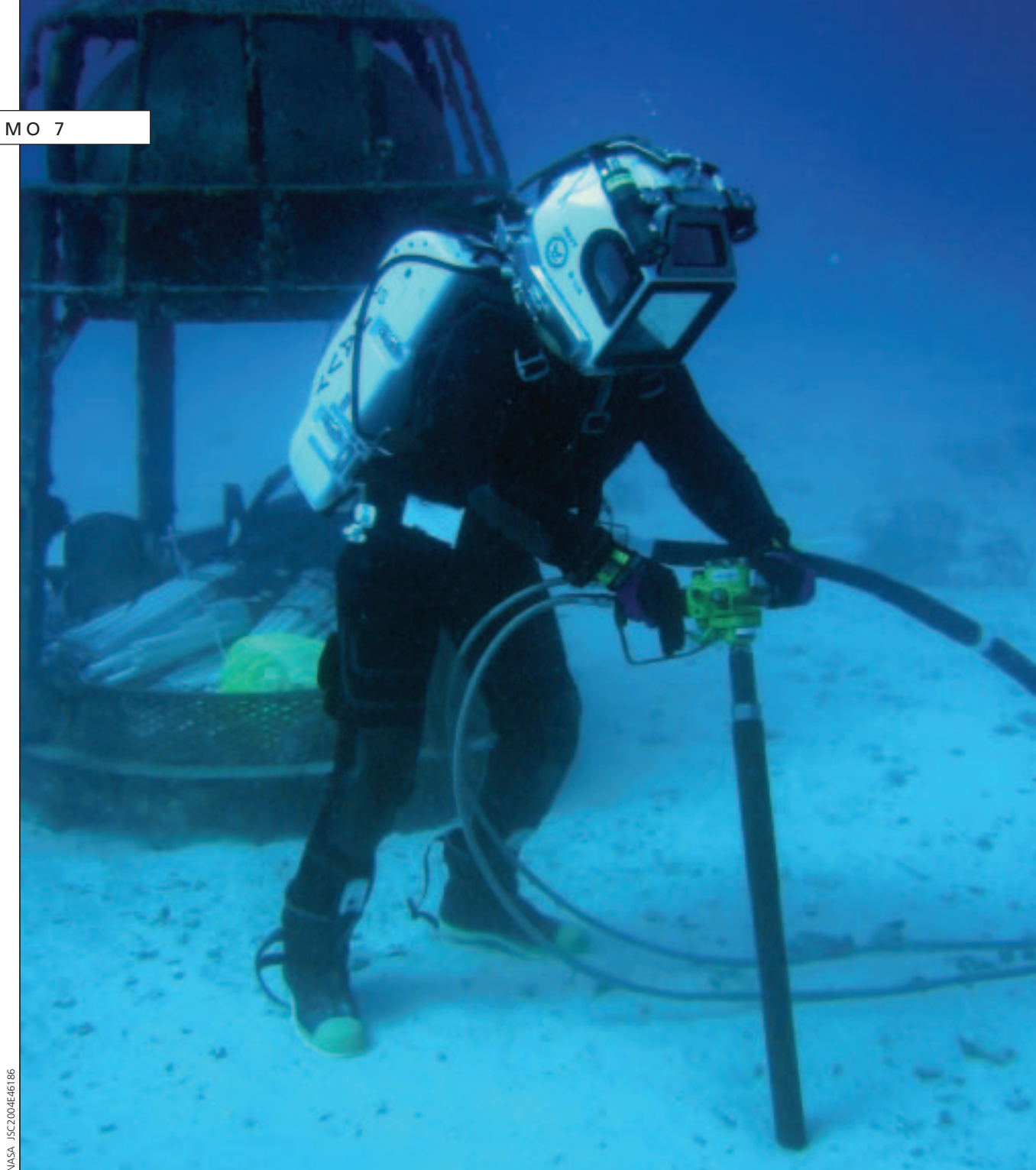


NASA/Blair JSC2004E29299

The Fielding and Humphries families, pictured at top, admire the Super Guppy at Wings Over Houston.

Above left, clowns from the Houston Livestock Show and Rodeo shared some smiles at the JSC Child Care Center.

An aspiring astronaut tries on a spacesuit at the All-Star FanFest.



NASA JSC2004E46186

## From the bottom up

Two NASA Extreme Environment Mission Operations (NEEMO) missions took place in 2004. NEEMO 6 was dedicated to biomedical engineering research, including evaluation of a wireless medical monitoring device and a handheld, noninvasive device that evaluates bone quality. NEEMO 7 focused on telemedicine. This long-distance health care could be crucial for medical emergencies on the International Space Station, the Moon or Mars.

# Exploration

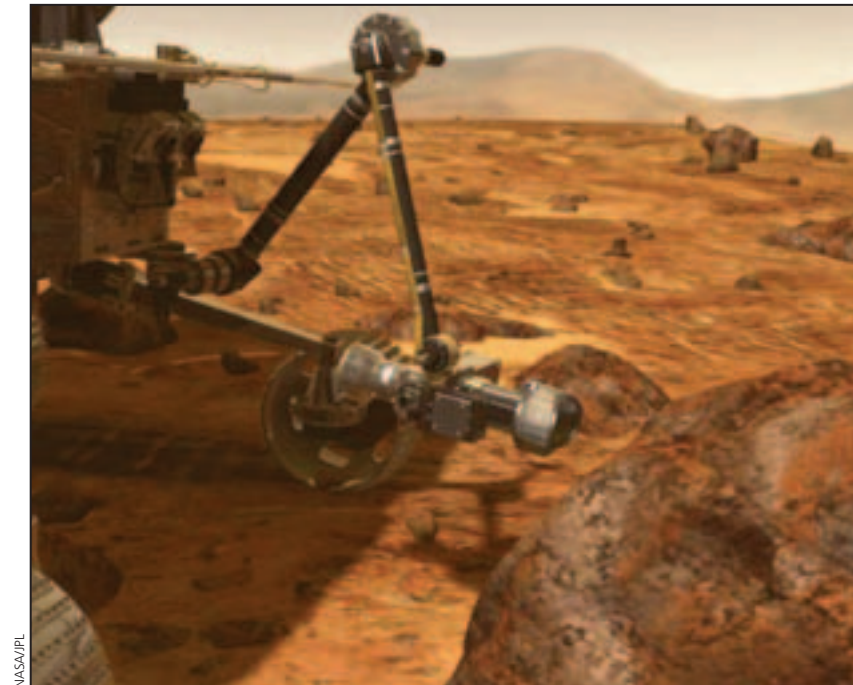
Although sending astronauts to Mars is still years away, JSC employees are taking crucial steps toward the **VISION FOR SPACE EXPLORATION** every day by learning more about our solar system and about living and working in space.

## Two members of JSC's

Astromaterials Research and Exploration Science team, Soil Mineralogist Doug Ming and Physical Chemist Dick Morris, played key roles in the Mars Exploration Rover missions. They spent months operating the rovers and sharing in science interpretation at NASA's Jet Propulsion Laboratory.

## A futuristic drilling rig

developed at JSC could eventually drill for resources, such as possible subsurface water, on Mars. The drill was tested in the Canadian Arctic in conditions similar to those found on Mars.



NASA/JPL

## The Desert Research and Technology Studies team

headed for Arizona for two weeks in September to test innovative equipment. The team included members from NASA centers, universities and private industry. The dusty, rough terrain and extreme temperature swings of the desert simulate some of the conditions that may be encountered on the Moon or Mars. The test equipment included new spacesuit helmet-mounted speakers and microphones for communications, a wireless network that can relay data among spacewalkers and robots as they explore, and "Matilda," an autonomous robotic support vehicle that can retrieve geologic samples.



NASA Haughton-Mars Project/Clancey

At top, the Rock Abrasion Tool on the robotic arm of the Mars Exploration Rover grinds away the rock's surface, allowing scientific instruments to analyze the rock's interior.

Above, the Haughton Impact Structure is a crater in the Canadian Arctic with features similar to those found on Mars.

# Discovery

## GENESIS BRINGS HOME PRECIOUS SAMPLES



NASA/JPL



NASA/JPL

At top, the Metal Glass Collector 2 measured helium and neon beyond solar wind energies. It was recovered fully intact.

Above, the Concentrator Target's number one priority for science recovery was to measure isotopic ratios of oxygen. Three of four segments were recovered intact (two silicon-carbide, one Carbon 13 Diamond). The fourth segment was about 85% recovered (diamond-on-silicon).

**THE GENESIS SOLAR-SAMPLE RETURN MISSION** made a hard landing in the Utah desert in September, but NASA managed to preserve a significant portion of the precious samples of the Sun it brought back from space.

The first scientific samples from the Genesis space probe arrived at Johnson Space Center on Oct. 4. Fragments from the capsule arrived by plane at Ellington Field and were transferred to a van for the short trip to the JSC Astromaterials Curation Facility. The quantity of material recovered from Genesis will be determined by further study at JSC.

The samples, which were numbered and packaged in separate carrying cases, were moved to the Genesis clean room where they are preserved and protected. Samples will be distributed to scientists to study over the coming months and years, beginning with members of the Genesis Science Team.

Genesis scientists believe that they will achieve the most important portions of their science objectives, which should tell us about the conditions when the Sun and planets were created more than 5 billion years ago. Genesis was launched in August 2001.

The samples are the first extraterrestrial matter returned by a U.S. spacecraft since 1972, when the last Moon rocks were carried back to Earth by Apollo astronauts.

# Technology

While NASA has an ample supply of vision and inspiration, it takes solid technology to bring those ideas to life. **INNOVATIVE TECHNOLOGY FLOURISHES AT JSC**, enabling the Center to play its part in fulfilling the Vision for Space Exploration.

**Robonaut** is a humanoid robot designed by the JSC Robot Systems Technology Branch in a collaborative effort with the Defense Advanced Research Projects Agency. Robonaut's purpose is to function as an equivalent for a spacewalking astronaut. Working alongside humans, or going where the risks are too great for people, Robonaut will help NASA build space telescopes, exploration vehicles and habitats, and harness the discoveries that are possible with these new systems.

## JSC technology transfer

strategic partnerships are a key mechanism for enabling technological growth for America's future in space. These strategic partnerships help to align JSC's way of doing business with that of the private sector. Combining the strengths of NASA's technological expertise and research facilities with commercial industry results in advances in technologies that work toward moving humans to a new odyssey of discovery.

**JSC took a giant step** for a cleaner environment by opening Houston's first ethanol fueling unit. The 1,000-gallon, onsite unit brings JSC into compliance with the Energy Policy Act of 1992, which requires that federal fleets reduce their petroleum use by 20 percent by 2005. Ethanol is distilled from corn, burns cleaner than gasoline and is renewable.



NASA/Starboard JSC2004E16341

Robonaut uses a standard human spacewalk tether to connect itself to an International Space Station exterior handrail on the test panel. The Robonaut Project is a collaborative effort with the Defense Advanced Research Projects Agency, and has been under development at Johnson Space Center for several years.



NASA/Stafford JSC2004E26288

## Extreme makeover

JSC's landmark rocket is getting a face-lift. The Saturn V on display at JSC has had its share of problems: corroded structures, mold and plant growth, and small animals sheltering inside the irreplaceable landmark. This year, the Smithsonian's National Air and Space Museum began preservation efforts on the rocket, including cleaning all rocket stages, removing fluids from tanks and lines, repainting surfaces and repairing damage. A temporary humidity-controlled building is also being built to protect the rocket during the preservation work.



NASA/DeHoyos JSC2004E33624

INTEGRITY

# History

## EVEN THE MOST EVERYDAY TASKS

performed at Johnson Space Center are pieces of America's spaceflight history. JSC teams work to preserve that history as they press toward the future.

## The JSC Oral History Project

team works to ensure that the details of our personal journeys in space exploration are preserved for future generations. Historians have talked to hundreds of individuals in the Mercury, Gemini, Apollo, Skylab and Shuttle programs who shared their personal experiences – from historical contributions to unique memories and stories.

## After a lifetime of ups and downs

– 34,700 ups and downs to be exact – NASA's last KC-135 aircraft, the "Weightless Wonder V," retired Oct. 29. The aircraft was part of JSC's Reduced Gravity Program, which provides a "weightless" environment for the development and verification of space hardware, research and crew training. The KC-135 will be replaced by the "Weightless Wonder VI," a C-9 aircraft acquired by NASA from the Navy.

## JSC employees celebrated

the 35th anniversary of the Apollo 11 Moon landing on July 20. Apollo-era employees shared stories that conveyed the tremendous energy and drive that it took to get to the Moon, and an amazing assortment of Apollo memorabilia was displayed in the Teague lobby. The items, all provided by JSC employees, ranged from lithographs to Apollo action figures. The highlight of the display was a lunar sample from Apollo 11, but even the more humble relics left an impression – large or small, they were treasured mementos of an exciting moment in American history.



NASA/Blair JSC2004E36237



NASA/Stafford JSC2004E0954

At top, John Yaniec, the lead test director for the Reduced Gravity Program, holds up a sign in celebration of his 30,000th parabola.

JSC employees gathered in the Teague auditorium to watch historical films about Apollo missions 8, 11 and 17 as part of the activities commemorating the 35th anniversary of the historic lunar landing that took place on July 20, 1969.

# Around the Center

**EMPLOYEE EVENTS AND ACTIVITIES** made for exciting times at the Center in 2004. Johnson Space Center implemented Starport, which began offering its galaxy of services to JSC employees. Starport aimed to create a more fulfilling work environment that highlights café improvements, better health selections, improved Gilruth workout facilities and fun employee activities.

**The College Football All-Star Challenge** made an appearance at JSC, bringing the media and football excitement to the forefront. This annual event, held in the midst of the Super Bowl frenzy, summoned several of college football's biggest and brightest stars to challenge their skills against each other in a variety of tests. The event also gave JSC a chance to showcase NASA to a national TV audience.

**The Apollo 11 35th Anniversary** allowed employees to step back in time and revel in one of NASA's greatest historic moments. The Apollo era came to life through stories shared by Apollo veterans at a celebration in the Teague Auditorium. Employees also had the chance to view artifacts and personal memorabilia from that time frame and even participate in a JSC Classic Car Parade throughout the Center.

**Beak's Bash** presented coworkers with the opportunity to display their talents and skits for the whole Center audience. Unfortunately, a storm cut the event at Ellington Field short and it has been postponed until this coming year.

Annual events such as **Safety & Total Health Day and American Heritage Day** brought out the workforce in masses. These events allow employees to take a break from their normal duties to reflect on issues such as safety, health, heritage and family.

Some lucky employees were able to become stars in their own right by acting as extras in the National Geographic documentary **"Expeditions to the Edge,"** which featured the Gemini 8 mission. The documentary, filmed in historic Mission Control, proved to be an experience many will not forget.



Clockwise from top right  
Sylvia Stottlemeyer enjoys the festivities at Beak's Beach Bash. NASA/Blair JSC2004E24459

Astronaut Mario Runco leans on his vintage car prior to the 35th Apollo Anniversary Car Parade. NASA/Schroeder JSC2004E30976

JSC employees line up for the JSC Safety and Total Health Day Fun Run. NASA/DeHoyos JSC2004E47967

Astronauts Dan Burbank on guitar and James Wetherbee on drums play as part of Max Q (astronaut band) during Beak's Bash. NASA/Blair JSC2004E24475

Jeff Smoker (Michigan State University) attempts a pass during the College Football All-Star Challenge. NASA/Markowitz JSC2004E01574



Lockheed Martin/NASA Michoud

*Let the journey begin*

The STS-114 crew is shown with the External Tank, which will carry the fuel for the next Space Shuttle flight.

SAFETY

safety

# Return to Flight

## SHUTTLE PROCESSING ACTIVITIES

at NASA's Kennedy Space Center, Fla., assumed a pre-launch rhythm after almost two years of innovative and intensive Agencywide effort to make the fleet safer. The most significant Return to Flight work was on the Shuttle External Tank, which was redesigned to minimize the amount of debris shed on liftoff. NASA also focused on its ability to assess the condition of Shuttles in orbit. The first Shuttle mission since the Columbia accident, STS-114 has a launch window opening in mid-May.

The STS-114 crewmembers will deliver supplies to the International Space Station, but the major focus of their mission will be testing and evaluating new Space Shuttle flight safety, which includes new inspection and repair techniques.

STS-114 is classified as Logistics Flight 1. Station-related activities include delivering new supplies and replacing one of the orbital outpost's Control Moment Gyroscopes (CMGs). STS-114 will also carry the Raffaello Multi-Purpose Logistics Module and the External Stowage Platform-2.

The crew is slated to conduct at least three spacewalks while at the Space Station. The first spacewalk will demonstrate repair techniques of the Shuttle's Thermal Protection System. During the second, the spacewalkers will replace the failed CMG with one delivered by the Shuttle. On the third, they will install the External Stowage Platform.



Lockheed Martin/NASA Michoud



NASA JSC2004E5650

Workers guide External Tank 120 (top) into the Vertical Assembly Building at Michoud Assembly Facility.

Wayne Smith prepares a Reinforced Carbon-Carbon test article in preparation for a critical Return to Flight arc jet test.

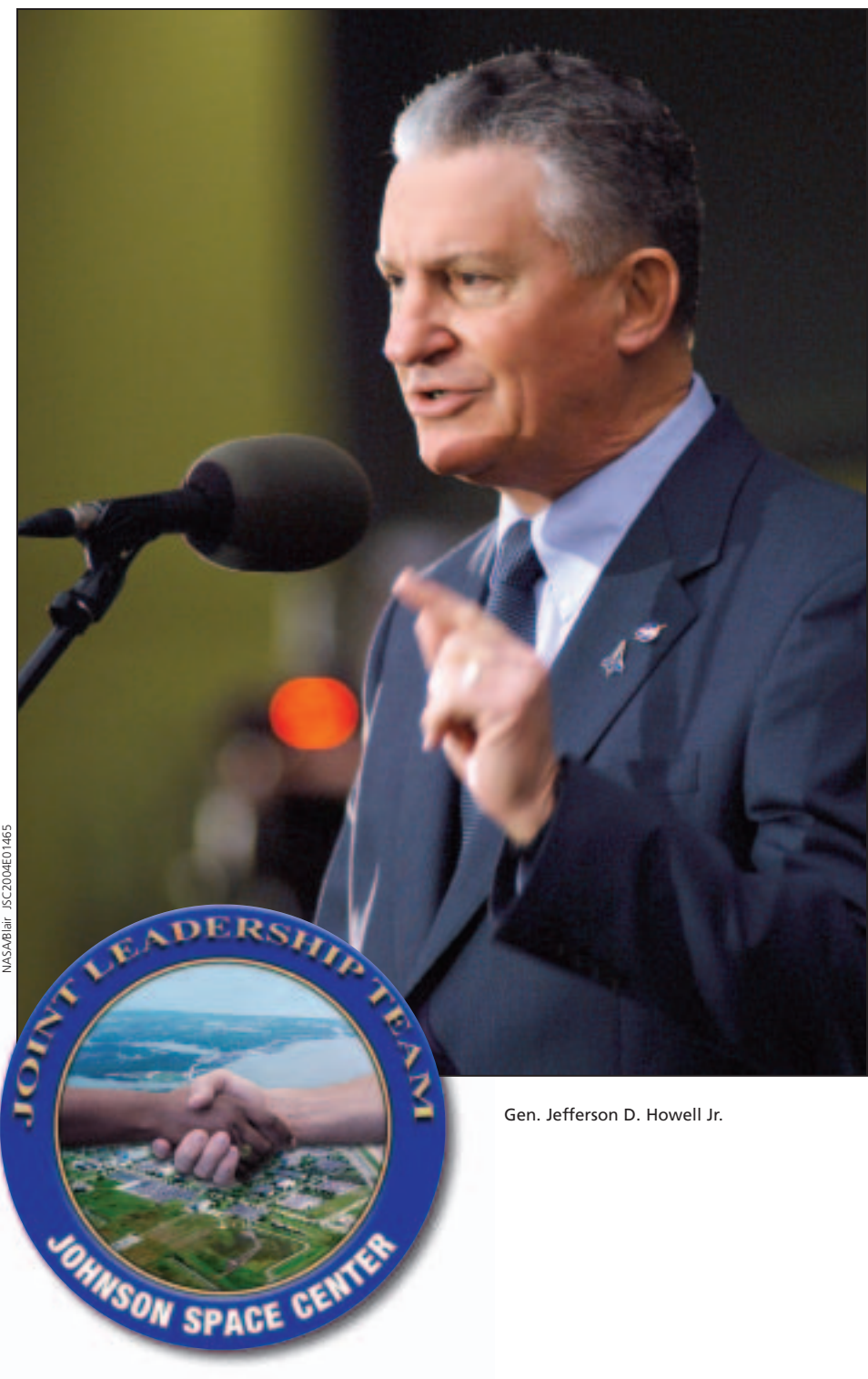
# NASA values: raising the bar through leadership and teamwork

**THE VALUES OF SAFETY, NASA FAMILY, EXCELLENCE AND INTEGRITY** have served as the heart of Johnson Space Center. At a town hall meeting in October 2004, Center Director Lt. Gen. Jefferson D. Howell Jr. compared these core values to the mast of an old sailing vessel:

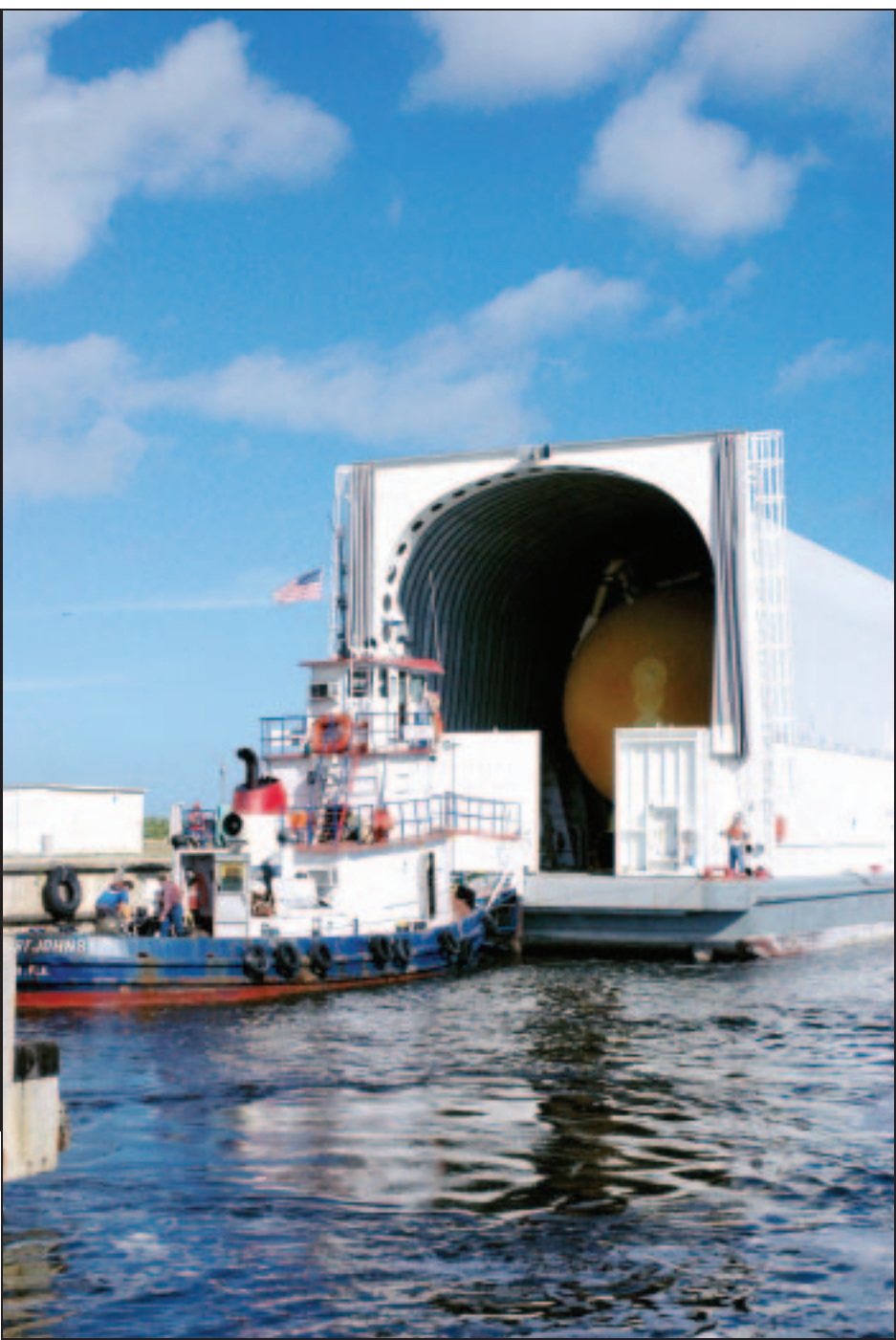
“When it got into stormy seas, the sailors would lash themselves to the mast of the ship because that was going to be the last thing to go. That’s what our core values are – in good times, bad times and difficult times. If we hang on to those core values ... we will get through this and get through it with flying colors.”

As JSC continued its efforts toward Return to Flight and the Vision for Space Exploration, JSC’s leadership team stayed focused on those values. As a result, a conglomerate of 41 senior managers from contractor companies and JSC senior management united to create the JSC Joint Leadership Team. It in turn spawned three teams aimed at enhancing leadership effectiveness, improving management processes and improving the effectiveness of contractor/civil servant communications and relationships: the leadership action team, the management processes team, and the contractor/civil servant relationships team.

The second in a series of Leader Led Workshops, emphasizing Agency transformation and the Vision for Space Exploration, was also held in 2004. These workshops, which resulted from the 2002 Agencywide “One NASA” survey, provide a way for senior Agency leaders to communicate to the workforce the connections between our top-level vision, mission and strategy and the day-to-day work of every employee. During these forums, employees from all levels have the opportunity to ask questions of NASA’s senior leaders.



Gen. Jefferson D. Howell Jr.



Tugboats maneuver the barge carrying the newly redesigned External Tank (ET), assigned for use on Return to Flight mission STS-114, closer to the dock at the Launch Complex 39 Area Turn Basin. The ET can be seen inside the barge.

**NASA HAS MADE SIGNIFICANT STRIDES** toward Return to Flight in 2004 and Johnson Space Center played a large role in this. NASA has closed several Columbia Accident Investigation Board recommendations. In addition to these recommendations, NASA also tackled other observations, non-Return to Flight recommendations and NASA-initiated “Raising the Bar” actions. Some of the recommendations included: Orbiter hardening, developing a formal procedure for inspection and repair of the Thermal Protection System, forming a Reinforced Carbon-Carbon (RCC) database and obtaining RCC spares.

As a result, many Return to Flight milestones have been achieved:

- External Tank Thermal Protection System modifications
- A series of rehearsals for Return to Flight, simulating a first-of-its-kind somersault that will expose the underside of the Space Shuttle for tile inspection, began in JSC’s Mission Control Center with participation from many other centers
- At Kennedy Space Center (KSC), a launch pad emergency was simulated in preparation for Return to Flight
- Also at KSC, Discovery’s main engines were installed

On Dec. 31, the new External Tank that will return Discovery to flight in late May embarked on a 1,000-mile journey to its new home at KSC. The arrival of the new tank at KSC on Jan. 6 marked a great beginning for a new year.

## EDUCATOR ASTRONAUTS



## Higher education

EXCELLENCE

excellence

Educator Astronauts help NASA develop exciting new ways to bring space exploration to students. Three new Educator Astronauts were named as part of the 2004 Astronaut Candidate Class: Joseph M. (Joe) Acaba, right; Richard R. (Ricky) Arnold II, center; and Dorothy M. (Dottie) Metcalf-Lindenburger, left.

# Education

## JOHNSON SPACE CENTER

takes “inspiring the next generation of explorers” very seriously, as shown by the 2004 education efforts described below. These represent just a handful of the Center’s education projects and programs that bring space to students every day.

**NASA’s 2004 Explorer Schools Program** provided information and interactive activities for more than 20,000 elementary to high school students in 46 states and Washington, D.C. The three-year partnership between NASA and selected schools in diverse communities offers opportunities and materials for teachers to spark interest in science, technology and math. Six new Explorer Schools were added in JSC’s region in 2004; each was welcomed to the NASA family by astronauts and Center personnel. In addition to these kickoff events, JSC employees visited about a half-dozen other Explorer Schools to keep students and teachers excited about spaceflight.

**JSC’s Distance Learning Network (DLN)**, an innovative teleconferencing education program, connected with nearly 800 different schools in 2004. Through the efforts of the DLN team, more than 22,000 students were able to participate in interactive teleconferences about spaceflight, physics, robotics and other topics.



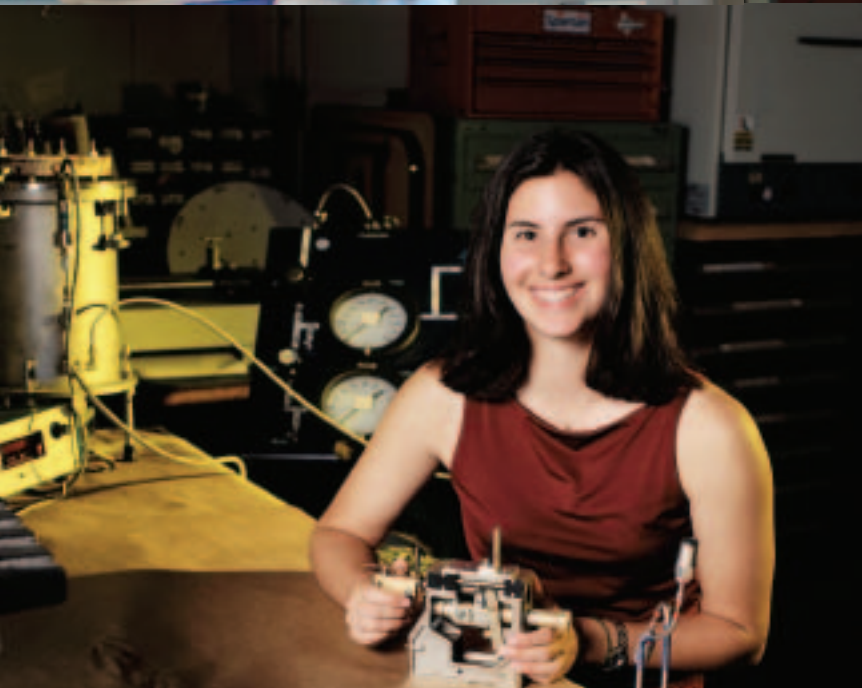
NASA/JSC/Stafford JSC2004E04803



NASA JSC2004E14751

Young students, top photo, listen intently to Astronaut Jim Reilly talk about the wonders of space at Stripling Middle School.

Students interface with NASA via the Digital Learning Network. A classroom representative can directly communicate audibly and visibly with the NASA Education Specialist.



Johnson Space Center strives to inspire the next generation of explorers by offering young people the opportunity to experience fascinating careers all across the Center.

*Clockwise, from top right*

Adriana Romero, Bldg. 29. NASA/Blair JSC2004E50126

Jackie Jaron, NBL Poolside. NASA/DeHoyos JSC2004E34690

Kenneth Armijo, Bldg. 222, HighBay. NASA/DeHoyos JSC2004-00221

Laura Brower, Bldg. 352. NASA/Markowitz JSC2004-00308

Matthew Fong, Bldg. 2, Teague Lobby. NASA/Blair JSC2004E52770

*Clockwise from top right*

Erin Reed, Bldg 9 NW ISS Mockup. NASA/Stafford JSC2004-00380

Lauren Johnson, Bldg. 9NW in front of the FFT Space Shuttle mockup. NASA/Blair JSC2004E54258

Alexandros Kanelakos, Bldg. 7, EVA Suit Lab. NASA/Blair JSC2004-00360

Jennifer Beall, JSC's Teague Auditorium. NASA/Blair JSC2004E26214



NASA/Markowitz JSC2004E37801

## To infinity and beyond

Representing the future of U.S. space exploration, NASA's 2004 astronaut candidate class was sworn in for duty on June 14. This class is unique in that it includes three Educator Astronauts, who have the distinctive role of using their experiences in space to enrich classroom learning. With their impressive skills and backgrounds, the 11 astronaut candidates will spread their enthusiasm for space to humankind as they explore new worlds.

The 11-member 2004 class of astronauts and three Japan Aerospace Exploration Agency astronauts take a break from training to pose for their group portrait at Johnson Space Center. Pictured are (first row, left to right), Robert L. (Bobby) Satcher Jr., Dorothy M. (Dottie) Metcalf-Lindenburger, Christopher J. (Chris) Cassidy, Richard R. (Ricky) Arnold II, Randolph J. (Randy) Bresnik and Thomas H. (Tom) Marshburn; (second row, left to right) Akihiko Hoshide, Shannon Walker, Joseph M. (Joe) Acaba, James P. (Jim) Dutton Jr., Robert S. (Shane) Kimbrough, Satoshi Furukawa, Jose M. Hernandez and Naoko Yamazaki.

## People

**NASA EMPLOYEES** are often called a “family” because of the unique bond that runs throughout the Agency. NASA coworkers support each other loyally, rejoicing in successes and working through setbacks. The NASA Family’s ingenuity, commitment and passion are, and always have been, the Agency’s greatest resources. JSC’s branch of the Family saw some changes and growth in 2004.

**Dr. Maxime Faget**, who is credited with contributing to the designs of every U.S. human spacecraft from Mercury to the Space Shuttle, died Oct. 9. During several decades of innovation, he received numerous honors including an induction into the National Space Hall of Fame in 1969 and the first Rotary National Award for Space Achievement in 1987.

**L. Gordon Cooper**, one of the original Mercury 7 astronauts, passed away on Oct. 4. The remaining members of this elite brotherhood, John Glenn, Scott Carpenter and Walter Schirra, shared stories about “Gordo” at a memorial service held at JSC, and NASA Administrator Sean O’Keefe posthumously awarded Cooper the NASA Distinguished Service Medal.

**John Young**, legendary astronaut and spaceflight icon, retired from NASA in December. Young’s first spaceflight was Gemini 3; later, he piloted the Apollo 10 Command Module, explored the Moon’s surface during Apollo 16 and commanded Space Shuttle Columbia’s maiden flight. Young, whose JSC posts included chief of the Astronaut Office and associate director (technical), remained an active astronaut until his retirement.



NASA 67-H-376



NASA 565-46900



NASA 572-16660

At top, Max Faget (foreground) and Astronaut Frank Borman inspect the interior of an Apollo Command Module mock-up at Kennedy Space Center on April 9, 1967.

Above left, L. Gordon Cooper Jr., command pilot for the Gemini 5 mission, standing in front of the launch pad in his pressure suit, minus the helmet.

John W. Young, pictured here in a 1972 photo, commanded the Apollo 16 lunar landing mission.

# Key elements of success

## Principal Functions

- Space Shuttle
- International Space Station
- Advanced Human Support Technology
- Biomedical Research and Countermeasures
- Space Medicine
- Space Operations/Communications Management
- Extravehicular Activity (EVA)
- Curatorial Care and Study of Lunar/Planetary Materials
- Astronaut Selection and Training

## Major Facilities

- Consolidated Mission Control Center (Shuttle and Station)
- Shuttle and Station Simulators and Trainers
- White Sands Test Facility (located in New Mexico)
- Shuttle Avionics Integration Laboratory (SAIL)
- Shuttle Engineering Simulator (SES)
- Biomedical Operations Laboratories
- Space Environment Simulation Laboratory (SESL)
- Vibration Acoustic Test Facility
- Anechoic Chamber Facility
- Lunar Sample Facility
- Sonny Carter Training Facility/Neutral Buoyancy Laboratory
- Human Research Facility (under development)



## Johnson Space Center Local Economic Impact of Civil Service Workforce in FY 2003

Communities	Total Number of Employees	Estimated Income• of Employees
		(Dollars in Millions)
Webster	107	9.5
League City	366	32.6
Seabrook/El Lago/Taylor Lake	262	23.3
Kemah/Bacliff	40	3.6
Nassau Bay	337	30.0
Clear Lake City	704	62.7
Friendswood	340	30.3
Dickinson	54	4.8
Alvin	42	3.7
Pearland	131	11.7
LaPorte/Shoreacres/Baytown	37	3.3
Pasadena/Deer Park	71	6.3
Other Houston Area	319	28.4
Other Galveston County**	117	10.4
TOTAL	2,927	260.6

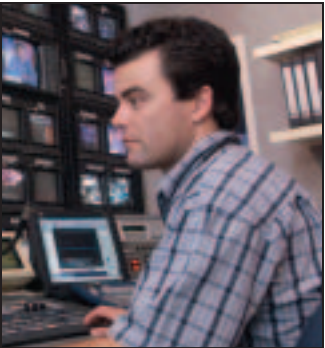
\* Information based on W-2 data provided by the JSC Financial Management Division (FMD). Income is defined as gross income less FICA, Health Insurance Tax (HIT) for Medicare, and Permanent Change of Station HIT related taxes and expenses. In addition to the current employees, there are JSC retirees living in the local area, but their economic impact is not reflected above.

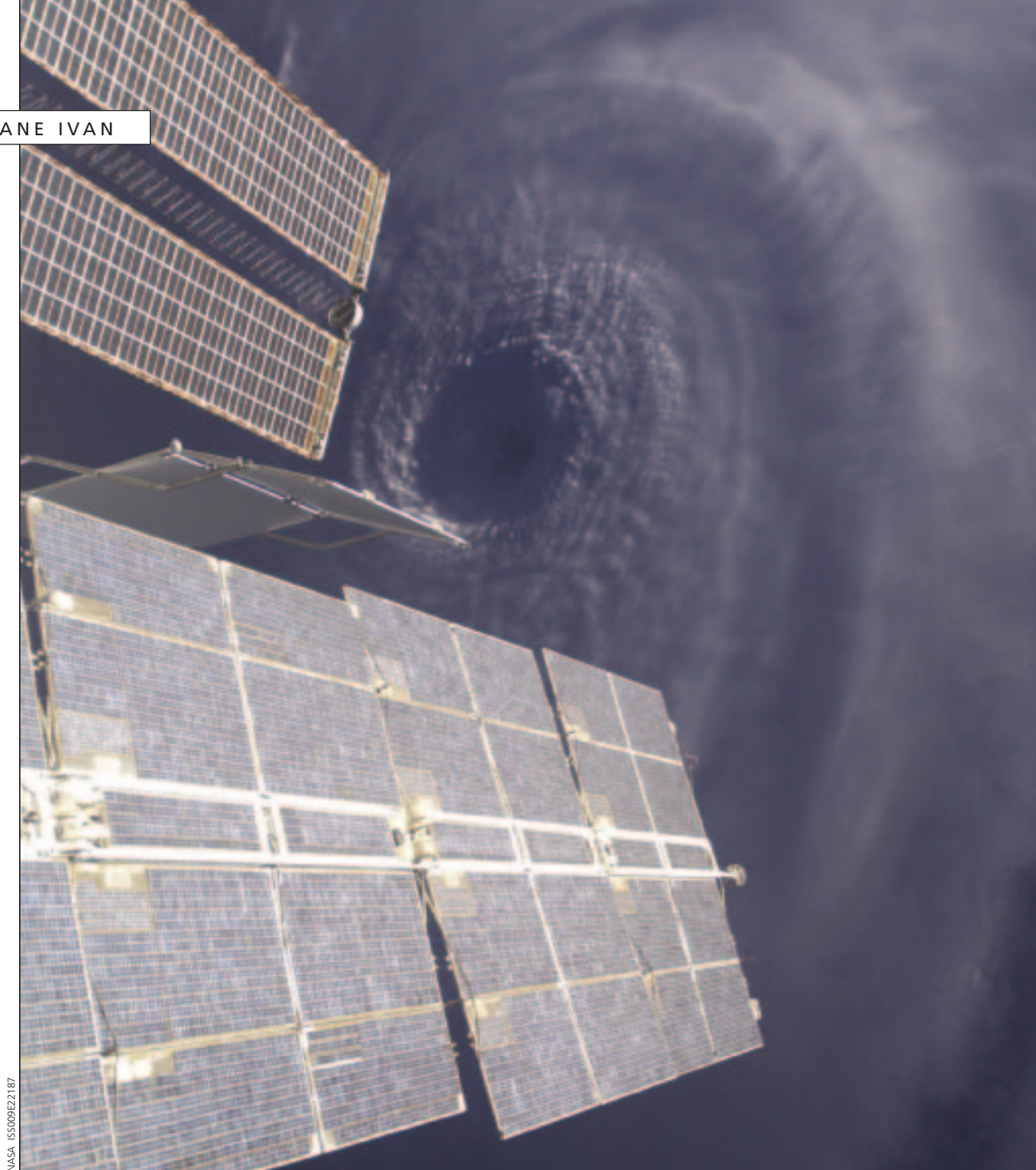
\*\* Includes LaMarque, Santa Fe, San Leon, Texas City, and the city of Galveston.

## Number of Employees at JSC

In January 1964, 2,100 employees were readying for the move onsite at JSC (known at that time as Manned Spacecraft Center) with the remaining 600 personnel to be onsite by July.

Today there are 3,000 civil service employees, the majority of whom are professional engineers and scientists. Of these, approximately 106 are active astronauts. Many companies provide contractor personnel to JSC. More than 12,000 contractors work onsite or in nearby office buildings and other facilities.





NASA ISS009E2187

## Eye of a storm

The number of photographs of Earth taken by International Space Station astronauts crossed the 100,000 mark in 2004. Space provides an unequalled vantage point for observing and tracking changes on Earth. Pictures of the planet from space

can greatly increase the understanding of Earth's ongoing transformations – both natural and human-caused.

This image features the eye of Hurricane Ivan, partially framed by solar array panels on the Space Station. One of the strongest hurricanes on record, Ivan was photographed on September 11, from an altitude of about 230 miles by Astronaut Edward M. (Mike) Fincke, NASA International Space Station science officer and flight engineer, aboard the orbital outpost. At the time, Ivan was reported to have winds of 160 mph.

# Space Station

## International Space Station enters its fifth year

Three crews lived on the Station during 2004 as the orbiting laboratory entered its fifth year as a staffed facility. Each two-person crew, working with ground teams, did its part to keep the Station safely operating. Crews made unprecedented repairs to an oxygen generator, a crucial piece of exercise equipment and a U.S. spacesuit. They also performed a spacewalk to restore power to a gyroscope.

## Year of firsts for Space Station crewmembers

All three U.S. crewmembers had personal milestones. Expedition 8 Commander Mike Foale returned to Earth as the U.S. record-holder for time in space, logging 374 days, 11 hours and 19 minutes over several missions. Expedition 9 Flight Engineer Mike Fincke is the first U.S. astronaut to have a child born while he was in orbit. Expedition 10 Commander Leroy Chiao is the first U.S. citizen to vote from space in a presidential election.

## Station research yields new health information

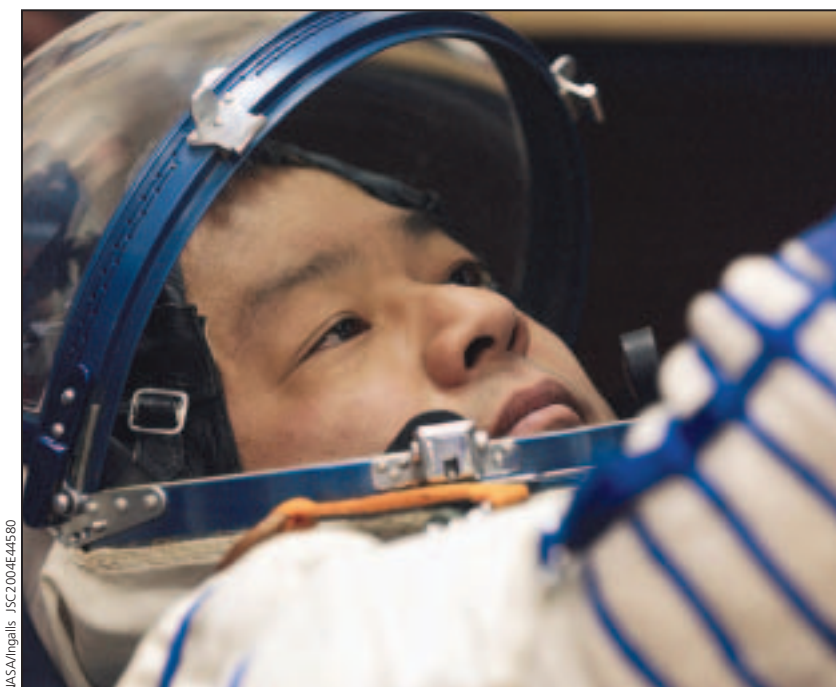
A NASA-funded study revealed how bone loss increases the risk of injuries, highlighting the need for additional measures to ensure the health of spacecraft crews. This research may aid people on Earth who suffer from similar conditions, including osteoporosis. Space Station astronauts, using ultrasound techniques developed by NASA, demonstrated the ability to quickly and remotely transmit medical data to the ground. These techniques are directly transferable for Earth use to improve patient care in remote locations.



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Astronaut C. Michael Foale, top left, Expedition 8 commander and NASA International Space Station science officer, in the Unity node of the Space Station.

Astronaut Edward M. (Mike) Fincke, Expedition 9 NASA International Space Station science officer and flight engineer, uses a microphone during a ham radio contact with the Palmer Research Station in Antarctica.

Astronaut Leroy Chiao, Expedition 10 commander and NASA International Space Station science officer, voted in the 2004 presidential election, making him the first U.S. citizen to do so from space.